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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

MAILED

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GROUP 1700

Application Number: 10/629,066
Filing Date: July 28, 2003
Appellant(s): HERMAN ET AL.

Jonathan M. Harris
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 22 August 2007 appealing from the Office action mailed 30 March 2007.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

2002/0114984	Edlund et al.	8-2002
6,348,278	LaPierre et al.	2-2002
3,539,397	Keating, Jr., et al.	11-1970

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 27-31and 34 are rejected under 35 U.S.C. 102(e) as being anticipated by Edlund et al. (2002/0114984).

Claim 27: Edlund et al. in Figures 5, 6, 10 and 11 disclose a fuel cell system (10), comprising:

a fuel cell stack (22) producing an anode effluent stream;

a hydrogen generation unit (12) configured to produce a hydrogen gas stream from an anode effluent stream. See paragraphs [0016]-[0047] and [0058]-[0061];

(Edlund et al. disclose in paragraph [0040] that the anode effluent (purge stream 84) may contain hydrogen gas. Alternatively, the hydrogen gas may be continuously vented from the anode region of the fuel cell stack and recirculated. And, in paragraph [0041], Edlund et al. disclose a combustion fuel stream 95 is schematically illustrated in FIG. 5. It should be understood that stream 95 may be formed from any suitable combustion fuel and may include some or all of one or more of the following: byproduct stream 40 from fuel processor 12, feed stream 16, or a slipstream of a component thereof, such as a stream containing carbon-containing feedstock 18, stored hydrogen gas from hydrogen storage system 58, vented gas from product hydrogen streams 14, 54, 56, 64 or 66, a fuel stream independent of the feed stream 16 or the byproduct streams from system 10, such as a supply of a suitable fuel... Accordingly, this anticipates a hydrogen generation unit (12) configured to produce a hydrogen gas stream from an anode effluent stream or any other hydrogen stream. Further, in paragraph [0040] feed stream 16 may be delivered to fuel processor 12 via any suitable mechanism. Although only a single feed stream 16 is shown in FIG. 1, it should be understood that more than one stream 16 may be used and that these streams may contain the same or different components. When carbon-containing feedstock 18 is miscible with water, the feedstock is typically delivered with the water component of feed stream 16, such as shown in FIG. 1. When the carbon-containing feedstock is immiscible or only slightly miscible with water, these components are typically delivered to fuel processor 12 in separate streams, such as shown in FIG. 2.

Accordingly, Edlund et al. anticipate a hydrogen generation unit (12) configured to produce a hydrogen gas stream from an anode effluent stream or any other hydrogen stream);

a hydrogen storage unit (60) into which a portion of the produced hydrogen gas stream is stored; and

a structure (i.e. hybride beds) coupled to the hydrogen storage unit. In particular, Edlund et al. in paragraph [0034] disclose metal hybride beds (which is the same as that instantly disclosed) as an example of a hydrogen storage device in which the metal hybride bed absorbs hydrogen gas at relatively low pressures and temperatures, and then desorbs the gas *at elevated temperatures and temperatures*. This disclosure has been construed as anticipating the claimed structure.

Further, the recitation ***that heats said fuel cell by promoting an exothermic reaction using the hydrogen from the hydrogen storage unit*** has been considered, and construed as a functional limitation that adds no additional structure to the fuel cell system. However, because the structural relationship between the hydrogen storage unit and the fuel cell stack are the same as that instantly claimed, and the reaction within the hydrogen storage unit is exothermic, the fuel cell system of Edlund et al. inherently would provide heat for fuel cell startup. Further, as to whether the heat is provided to the fuel cell stack for fuel cell start up is dependent upon the manner in which the fuel cell is to be operated.

Claim 28: Edlund et al. disclose that the hydrogen storage unit (60) comprises one or more mechanisms selected from the group consisting of metal hydride bed, hydrogen sorption material, and compressed gas bottle (paragraph [0033]).

Claim 29: Edlund et al. disclose that the hydrogen storage unit (60) comprises a metal hydride (paragraph [0033]).

Claim 30: Edlund et al. in Figure 3 disclose that the hydrogen generation unit (30) comprises a hydrogen separation membrane (44) (paragraph [0026]).

Claim 31: Edlund et al. in Figure 7 disclose a temperature control unit. More particularly, Edlund et al. disclose one or more sensors (124) to measure or detect selected values, or operating parameters, such as temperature via a temperature sensor. The sensors communicate with a processor (122) via a communication linkage (126). The processor further communicates with a controlled device (128) (paragraphs [0048]-[0050]).

Claim 34: Edlund et al. disclose a hydrogen means for providing additional power during high load on the fuel cell stack (paragraphs [0036], and [0059]-[0061]).

Claim Rejections - 35 USC § 103

5. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Edlund et al. as applied to claim 27 above, and further in view of LaPierre et al. (6,348,278).

Edlund et al. are as applied, argued, and disclosed above, and incorporated herein.

Claim 32: Edlund et al. do not disclose that the temperature control unit is a heat exchanger.

LaPierre et al. in Figures 1 and 2 disclose a heat exchanger (66) (col. 13: 65-col. 14: 18). More particularly, La Pierre et al. disclose that a purified hydrogen stream exiting a hydrogen separating membrane is directed into a heat exchanger to cool the hydrogen to a temperature compatible with the fuel cell.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the apparatus of Edlund et al. by incorporating the heat

exchanger of LaPierre et al. because both are concerned with feeding a reformate stream (purified hydrogen stream) to a fuel cell, wherein the reformate has passed through a separating membrane, and further LaPierre et al. disclose a heat exchanger that would have cooled the hydrogen to a temperature that is compatible with the operation of the fuel cell thereby improving the overall performance of the fuel cell system.

4. Claims 36-38, 40 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Edlund et al. in view of Keating, Jr., et al. (3,539, 397).

Claim 36: Edlund et al. in Figures 5, 6, 10 and 11 disclose a fuel cell system (10), comprising:

a fuel cell stack (22);

a means (12)(paragraphs [0024]-[0025]) for obtaining hydrogen from an anode effluent stream. See paragraphs [0016]-[0047] and [0058]-[0061];

Edlund et al. in paragraph [0040] disclose that the anode effluent (purge stream 84) which may contain hydrogen gas. Alternatively, the hydrogen gas may be continuously vented from the anode region of the fuel cell stack and recirculated. And, in paragraph [0041], Edlund et al. disclose a combustion fuel stream 95 is schematically illustrated in FIG. 5. It should be understood that stream 95 may be formed from any suitable combustion fuel and may include some or all of one or more of the following: byproduct stream 40 from fuel processor 12, feed stream 16, or a slipstream of a component thereof, such as a stream containing carbon-containing feedstock 18, stored hydrogen gas from hydrogen storage system 58, vented gas from product

hydrogen streams 14, 54, 56, 64 or 66, a fuel stream independent of the feed stream 16 or the byproduct streams from system 10, such as a supply of a suitable fuel... Accordingly, this anticipates a hydrogen generation unit (12) configured to produce a hydrogen gas stream from an anode effluent stream or any other hydrogen stream. Further, in paragraph Feed stream 16 may be delivered to fuel processor 12 via any suitable mechanism. Although only a single feed stream 16 is shown in FIG. 1, it should be understood that more than one stream 16 may be used and that these streams may contain the same or different components. When carbon-containing feedstock 18 is miscible with water, the feedstock is typically delivered with the water component of feed stream 16, such as shown in FIG. 1. When the carbon-containing feedstock is immiscible or only slightly miscible with water, these components are typically delivered to fuel processor 12 in separate streams, such as shown in FIG. 2.

Accordingly, Edlund et al. anticipate a hydrogen generation unit (12) configured to produce a hydrogen gas stream from an anode effluent stream or any other hydrogen stream); and,

a means for storing hydrogen (60) (paragraph [0033]).

Edlund et al. does not disclose a means for heating the fuel cell stack and for speeding up fuel cell startup.

Keating, Jr., et al. disclose in Figure 1 a means (start-up heater 60) for heating the fuel cell stack and for speeding up fuel cell startup (col. 3: 47-col. 4: 31).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the fuel cell stack of Edlund et al. by incorporating the startup heater of Keating, Jr., et al. because Keating Jr., et al. disclose a means (start-up heater

60) for heating the fuel cell stack and for speeding up fuel cell startup that would have provided improved control over the temperature at which the process in a fuel cell is carried out thereby improving the overall performance of the fuel cell.

Claim 37: The rejection of claim 37 is as set forth above in claim 29.

Claim 38: The rejection of claim 38 is as set forth above in claim 30.

Claim 40: The rejection of claim 40 is as set forth above in claim 31.

Claim 43: The rejection of claim 43 is as set forth above in claim 34.

6. Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over Edlund et al. in view of Keating, Jr., et al. as applied to claim 36 above, and further in view of LaPierre et al. (6,348,278).

Edlund et al. and Keating are as applied, argued, and disclosed above, and incorporated herein.

Claim 41: The Edlund et al. combination does not disclose that the temperature control unit is a heat exchanger.

LaPierre et al. in Figures 1 and 2 disclose a heat exchanger (66) (col. 13: 65-col. 14: 18). More particularly, La Pierre et al. disclose that a purified hydrogen stream exiting a hydrogen separating membrane is directed into a heat exchanger to cool the hydrogen to a temperature compatible with the fuel cell.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the apparatus of the Edlund et al. combination by incorporating the heat exchanger of LaPierre et al. because both are concerned with feeding a

reformate stream (purified hydrogen stream) to a fuel cell, wherein the reformate has passed through a separating membrane, and further LaPierre et al. disclose a heat exchanger that would have cooled the hydrogen to a temperature that is compatible with the operation of the fuel cell thereby improving the overall performance of the fuel cell system.

(10) Response to Argument

The Applicants argue that claim 27 requires a structure that that "heats said fuel cell stack by promoting an exothermic reaction using hydrogen from said hydrogen storage unit." The Examiner noted that Edlund discloses metal hydride beds that desorb the gas at elevated temperatures. Edlund, however, does not teach or even suggest using heat to heat the fuel cell stack. Edlund does not teach or suggest using heat generated from an exothermic reaction involving hydrogen to heat the fuel cell stack. As noted above, Edlund is directed to proton exchange membrane (PEM) and alkaline types of fuel cells. Para. [0023]. Unlike solid oxide fuel cells, the types of fuel cells disclosed in Edlund need not be substantially heated for the fuel cell to operate. Accordingly, Edlund does not disclose a mechanism or even a desire to heat fuel cells during a start-up process. Thus, although Edlund refers to metal hydride beds, Edlund does not teach or suggest a metal hydride bed to generate heat for heating the fuel cell stack.

In response:

1. The arguments are not commensurate in scope with claim 27 because claim 27 is not limited to a solid oxide fuel cell. Edlund et al. in paragraph [0023] disclose, "Examples of suitable fuel cells include proton exchange membrane (PEM) fuel cells and alkaline fuel cells." *Example of* has been construed as non-limiting and encompassing of other types of fuel cells.

Further, Edlund el al. disclose in paragraph [0066] discloses, “The present invention is applicable in any fuel processing system or fuel cell system in which hydrogen gas is produced for delivery to a fuel cell stack or other hydrogen-consuming device.” Such disclosure has been construed as encompassing a solid oxide fuel cell as well as the exemplary fuel cells disclosed in paragraph [0023]. Also, the instant specification in paragraph [0012] discloses, “The particular type and design of the fuel cell stack 110 is not critical to the invention.” Therefore, in light of Edlund et al. other fuel cells types and designs can be used to practice the invention.

2. Edlund et al. shows in Figure 5, shows the fuel cell stack receiving a hydrogen stream 66 from the hydrogen storage device 60. Instant Figure 1 also shows fuel cell stack receiving a hydrogen stream from the hydrogen storage device. Edlund et al. in paragraph [0033] disclose that suitable hydrogen storage devices include metal hydride beds. Metal hydride beds provide an example of a hydrogen storage device that does not require a hydrogen compressor. Metal hydride beds absorb hydrogen gas at relatively low pressures and temperatures, and then desorb (i.e. discharge) this gas at elevated temperatures and pressures. The instant application also discloses hydrogen storage devices include metal hydride beds. Because the structural relationship between the hydrogen storage unit and the fuel cell stack are the same as that instantly claimed, and because the manner is which fuel cell system is operated (i.e. the fuel cell receives a hydrogen gas stream from the hydrogen storage device, and the reaction within the hydrogen storage unit is exothermic, the fuel cell system of Edlund et al. inherently would provide heat generated from an exothermic reaction involving hydrogen to heat the fuel cell stack.

The Applicants argue that claim 36 requires a "means for heating said fuel cell stack and for speeding up fuel cell startup." The Examiner acknowledged that Edlund lacks such a means. Instead, the Examiner turned to Keating. The Examiner stated that "it would have been obvious to one of ordinary skill in the art...to have modified the fuel cells stack of Edlund et al. by incorporating the startup heater of Keating...thereby improving the overall performance of the fuel cell." Office Action p. 8. Appellants respectfully submit that the Examiner's analysis is flawed. As explained above, the type of fuel cell (PEM) taught by Edlund need not be substantially heated for the fuel cell to operate and would not benefit from such heating. Thus, one of ordinary skill in the art would not have found it advantageous or desirable to modify Edlund to incorporate Keating's startup heater. Moreover, the Examiner is incorrect in asserting that Edlund's fuel cell would experience an improvement in overall performance if it were modified to include the startup heater of Keating.

In response:

1. The response to the Applicants argues as set forth above pertaining to claim 26 are as applied, argued, and disclosed above, and incorporated herein.

2. The Applicant appears to be arguing that there is not motivation to combine. Keating, Jr., et al. disclose in Figure 1 a means (start-up heater 60) for heating the fuel cell stack and for speeding up fuel cell startup (col. 3: 47-col. 4: 31). In particular, Keating, Jr., et al. disclose on col. 4: 5-10 that the startup heater 60 has a heat source portion 88 which is in the exhaust line 90 of the burner 24 of the hydrogen generator to warm up the coolant for the fuel cell 18. The heater 60 is advantageous during the process of starting up the fuel cell powerplant, so that when

hydrogen is available from the hydrogen generator 10, and the hydrogen input valve 12 may be opened, the coolant will have already established a nominal operating temperature whereby steady-state operation may be achieved much more quickly in the fuel cell 18. The use of the startup heater 60 provides rapid establishment of steady state operating conditions without the need for a special heater or the consumption of any additional fuel.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the fuel cell stack of Edlund et al. by incorporating the startup heater of Keating, Jr., et al. because Keating Jr., et al. disclose a startup heater that would have provided advantages during the process of starting up the fuel cell powerplant, so that when hydrogen is available from the hydrogen generator, and the hydrogen input valve may be opened, the coolant will have already established a nominal operating temperature whereby steady-state operation may be achieved much more quickly in the fuel cell, and provide rapid establishment of steady state operating conditions without the need for a special heater of the consumption of any additional fuel thereby improving fuel cell performance, provide cost savings associated with the elimination of a special heater and addition fuel for consumption.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Thomas H. Parsons

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